

REVIEW OF THE INDO-PACIFIC PIPEFISH GENUS  
*BHANOTIA*, WITH DESCRIPTION OF *B. NUDA* N. SP.

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*Abstract.*—The genus *Bhanotia* Hora is diagnosed and differentiated from other syngnathine (tail-pouch) genera with similar body ridge configuration (*Syngnathus* Linnaeus, *Corythoichthys* Kaup, *Bryx* Herald) by the combination of spiny snout, protected nares, well developed pouch plates in males and presence of free bony plates in opercular membranes of sub-adults and/or adults. The type-species, *Bhanotia fasciolata* (Duméril), with modally 15 trunk rings, and *B. nuda* n. sp. (modally 14 trunk rings) from the Palau Is. and New Guinea are described and illustrated.

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Hora's (1925) description of *Bhanotia* was not clearly diagnostic, and the status of this Indo-Pacific syngnathine (tail-pouch) pipefish genus has subsequently been in doubt. Hora considered *Bhanotia* to be closely related to *Corythoichthys* Kaup, and both Parr (1930) and Herald (1940), without pertinent comparative material, made unsuccessful attempts to clarify this relationship. Herald (1953, in Key) retained separate status for *Bhanotia*, and I have recently (Dawson, 1977a and b) compared the genus with *Corythoichthys* and clarified the nomenclature of the type-species, *Bhanotia fasciolata* (Duméril). Subsequent study of all available collections permits the present review of *Bhanotia* and description of a new species from New Guinea and Palau.

#### Methods and Materials

Methods follow Dawson (1977a); measurements are in millimeters (mm); proportional values are referred to standard length (SL) or head length (HL); color descriptions are from specimens preserved in alcohol. Materials examined are listed from west to east and roughly north to south; depths are in meters (m); latitude and longitude are approximations; the map delineates general localities and may not show all collection sites in immediate vicinity of symbols.

Abbreviations for repositories of examined material: AMS—Australian Museum, Sydney; BPBM—Bernice P. Bishop Museum, Honolulu; CAS—California Academy of Sciences; CAS-SU—former Stanford University specimens now housed at CAS; GCRL—Gulf Coast Research Laboratory Museum; MNHN—Muséum National d'Histoire Naturelle, Paris; RMNH—Rijksmuseum van Natuurlijke Historie, Leiden; UF—Florida State Museum, Gainesville; USNM—National Museum of Natural History, Smithsonian Institution; UZMK—Universitetets Zoologiske Museum, Copenhagen; ZSI—Zoological Survey of India, Calcutta.

*Bhanotia* Hora

*Bhanotia* Hora, 1925:463 [type-species by original designation: *Syngnathus corrugatus* Weber, 1913 (equals *Syngnathus fasciolatus* Duméril, 1870)].

*Diagnosis.*—Superior trunk and tail ridges discontinuous near rear of dorsal fin; lateral tail ridge ends near anal ring; lateral trunk ridge ends near anal ring, usually straight but often with a slight deflection ventrad, not reaching confluent inferior trunk and tail ridges (Fig. 5); trunk deep in subadults and adults, venter distinctly V-shaped, with or without a median ventral keel; scutella inconspicuous, without longitudinal keel, their width less than half of ring length; median dorsal snout ridge short, largely restricted to posterior third of snout, ends on anterior third of interorbital, not confluent with orbital ridges; anterodorsal portion of snout margined bilaterally by a short, diagonal, entire or spiny ridge (Fig. 3); dorsum of snout elsewhere with somewhat irregularly distributed rows of conical spines and/or short spiny ridges; nares 2-pored bilaterally, protected above by platelike bony lateral projections which terminate distally in 1–4 spiny points; lateral snout ridge absent; orbital ridges rather broad and somewhat expanded laterad; opercle with complete or nearly complete median longitudinal ridge which may be straight or angled somewhat dorsad, opercle crossed elsewhere with low ridges or striae; low ridge protrudes laterad above posterior third of opercle, another above gill opening; subadults and/or adults with one to several bony plates suspended in opercular membrane (Fig. 3); nuchal, prenuchal and frontal ridges somewhat elevated; pectoral-fin base not protruding strongly laterad, usually with indications of two longitudinal ridges; body ridges distinct, rather deeply notched between trunk rings, indented between tail rings; dorsum of trunk somewhat depressed between superior ridges, surfaces of tail slightly depressed between principal ridges; most head and body surfaces rough, ornamented with minute ridges and pocklike indentations, devoid of dermal flaps or papillae; dorsal-fin base not elevated; dorsal-fin membrane closely bound to fin-rays. Head length (HL) 8.1–11.0 in SL; snout length 2.6–3.3 in HL; length of dorsal-fin base 0.8–1.1 in HL; trunk rings 13–16; total rings 51–58; subdorsal rings 6.25–8.00, mostly on tail; dorsal-fin rays 26–35; pectoral-fin rays 12–16; anal fin present, caudal-fin rays 10. Brood pouch under tail; pouch protective plates present; brood-pouch eggs in two transverse rows and in 1–2 layers, not in continuous gelatinous matrix, covered by protective folds which meet and turn dorsad on ventral midline; brood-pouch closure the inverted type of Herald (1959). Without odontoid processes in jaws (Dawson and Fritzsche, 1975). Maximum size at least 84 mm SL. Indo-Pacific.

*Comparisons.*—Among syngnathine genera, the *Bhanotia* configuration of principal body ridges is shared with *Corythoichthys* Kaup, *Syngnathus* Linnaeus and *Bryx* Herald. *Bhanotia* shares the combination of pouch pro-

Table 1. Frequency distributions of trunk, tail and total rings in species of *Bhanotia*.

Species Locale	Trunk rings						Tail rings						Total rings					
	13	14	15	16	37	38	39	40	41	42	51	52	53	54	55	56	57	58
<i>B. fasciolata</i>																		
Andaman Is.			1	1						2							1	1
Thailand			6					2	4					4		2	4	
Philippine Is.	1	13				3	7	3	1					4	7	2	1	
Indonesia	1	34*				2	10*	23						3	9*	23		
New Guinea			1					1							1			
Solomon Is.			16			6	7	2	1					6	7	2	1	
Santa Cruz Is.	1	25					12	13	1						13	12	1	
New Hebrides			24	2		2	13	10	1					2	12	10	2	
<i>B. nuda</i>																		
New Guinea			16	1		4	7	6						4	8		4	1
Palau Is.	1	40*			3	22*	13	3			4	21*	13	3				

\* Holotype.

Table 2. Frequency distributions of dorsal and pectoral-fin rays and paired (equivalent) pectoral ray counts in species of *Bhanotia*.

Species Locale	Dorsal-fin rays										Pectoral-fin rays						Paired pectoral counts							
	26	27	28	29	30	31	32	33	34	35	12	13	14	15	16	12	13	14	15	16				
<i>B. fasciolata</i>																								
Andaman Is.						2								2	2					1	1			
Thailand			2	2	2									5	6					2	3			
Philippine Is.			2	6	5									6	5					3	2			
Indonesia			2*	6	19	7	1							2	19	20*				1	16	8*		
New Guinea							1							1	1									
Solomon Is.							5	7	3					4	14	1				2	5			
Santa Cruz Is.					2	5	5	6	10	3				7	27	14				2	10	5		
New Hebrides			1			1	7	9	1					1	11	14					4	5		
<i>B. nuda</i>																								
New Guinea	1	4	9	3																1	8			
Palau Is.		7	14*	13	8														3	52*	13	1	21*	4

\* Holotype.

Table 3. Frequency distributions of subdorsal trunk and tail rings in species of *Bhanotia*.

Species Locale	Trunk rings										Tail rings						
	1.75	1.50	1.25	1.00	0.75	0.50	0.25	0.00	5.50	5.75	6.00	6.25	6.50	6.75	7.00	7.25	
<i>B. fasciolata</i>																	
Andaman Is.		1		1							1	1					
Thailand				4		2				1	3		2				
Philippine Is.			1	9	2	3				3	2	7		1	2		
Indonesia		2	2	17	13	3*			1		9	10*	13	1	2	1	
New Guinea				1									1				
Solomon Is.	2	4	3	5	1	1			1	1	3	6	3	2			
Santa Cruz Is.		2	2	16	4	2			1		2	8	9	5	1		
New Hebrides		2	5	13	5	3				1	2	5	7	4	7	2	
<i>B. nuda</i>																	
New Guinea				3	6	6	1	1	1	1	3	7	5				
Palau Is.				14	9*	16	1	2	1	6	8	16	7*	4			

\* Holotype.



Table 4. Frequency distributions of total subdorsal rings in species of *Bhanotia*.

Species Locale	Total subdorsal rings							
	6.25	6.50	6.75	7.00	7.25	7.50	7.75	8.00
<i>B. fasciolata</i>								
Andaman Is.					1	1		
Thailand			1	5				
Philippine Is.		1	4	3	4		2	1
Indonesia		1	3*	6	15	10	1	1
New Guinea						1		
Solomon Is.					5	9	2	
Santa Cruz Is.			2	2	5	13	4	
New Hebrides				1	5	10	5	7
<i>B. nuda</i>								
New Guinea	1	2	5	8	1			
Palau Is.	2	4	14	13	8*	1		

\* Holotype.

tective plates and inverted pouch closure with some species of *Syngnathus* (e.g. subgenus *Syngnathus* sensu Herald, 1959), whereas pouch plates are absent in *Corythoichthys* and pouch closure is the semi-type in both *Bryx* and *Corythoichthys*. Despite certain shared features, the spiny snout of *Bhanotia*, together with protected nares (largely concealed dorsad by overhanging bony protrusions) and occurrence of free bony plates within the opercular membrane constitute a character combination not found in other pipefishes.

*Remarks.*—Although usually terminating parallel to the longitudinal body axis, the lateral trunk ridge occasionally deflects 10–15° ventrad over the last 1–2 trunk rings. Among examined material, however, the lateral trunk ridge always ends well above the continuous inferior ridge.

The diagonal anterodorsal snout ridge is distinct at  $\times 30$  magnification in specimens as small as 30.5 mm SL, and the entire or spiny nature of this ridge (Fig. 3) is readily determined in all study material. Distribution of other spines or spiny ridges on dorsum of snout is variable and frequency of spines appears to increase with increasing standard length. Some well developed dorsal snout spines are present laterally and on midline in all examined specimens.

Development of bony plates in the opercular membrane is ontogenetic (Fig. 3). Plates are not usually visible in untreated specimens smaller than about 54 mm SL, whereas they are readily seen under low magnification in most *B. fasciolata* longer than about 57 mm SL. Minute bony precursors are visible at  $\times 60$  magnification in some 52 mm SL bleached and stained specimens.

Brood-pouch eggs essentially spherical, arranged in two uncrowded parallel rows and in either one or two layers; egg-rows not separated by a median longitudinal membranous septum but dorsum of pouch and inner surfaces of pouch folds with low membranous ridges; pouch folds inverted on ventral midline so that folds completely cover eggs and fold margins extend dorsad over ventral  $\frac{1}{3}$ - $\frac{1}{2}$  of lowermost eggs. Among examined material, the smallest egg-bearing male is 47.5 mm SL, smallest male with developing pouch folds is 46.0 mm SL and maximum number of brood-pouch rings is 13.

The anal fin is very short, its breadth about equal to length; anal rays covered by fleshy integument and difficult to count but there appear to be 3 rays in most specimens; anal fin usually included within anterior extremity of brood pouch in mature males.

Ground color tan to dark brown in alcohol, head and trunk usually darker than tail; markings brown to light tan.

Although one collection (*B. nuda*) is recorded from a "mudflat," remaining samples with adequate data have all been taken in tidepool or reef habitats. One collection is recorded from "brackish" water. Although definite information is lacking for other samples, most would appear to be from marine or high salinity waters. Maximum recorded capture depth is a SCUBA collection in 13.7-16.8 m (USNM 210658; *B. fasciolata*).

*Discussion.*—With the exception of brief mention of snout spines, Hora's (1925) generic diagnosis could apply to a number of species commonly referred to *Syngnathus*. Unfortunately, Hora overlooked Weber and de Beaufort's (1922) reference to the protected nares in the holotype of *Syngnathus corrugatus* and failed to mention (or illustrate) the opercular membrane plates present in his adult male (ZSI F.10823-1) and in the female holotype of *Bhanotia sewelli* (ZSI F.10690-1). Similar configurations of principal body ridges and brood pouch suggest close relationship to *Syngnathus*, but the unique combination of spiny snout, protected nares and free opercular plates clearly indicates separate lineage for *Bhanotia*. Functional significance of these features is unknown but they afford strong evidence that species of *Bhanotia* are adapted to a specialized habitat not commonly occupied by other syngnathine pipefishes.

*Bhanotia fasciolata* (Duméril)

Fig. 1

*Corythoichthys fasciculatus* Kaup, 1853:231 (nomen nudum; Java).

*Corythoichthys gastrotaenia*: Kaup, 1856:27 [misidentification; new combination; not *Syngnathus gastrotaenia* Bleeker, 1852; description; Wahai and Ceram (incorrect locality)].

*Corythoichthys fasciolatus* Kaup, 1856:27 (erroneous spelling of *C. fasciculatus* Kaup, 1853; as synonym of *C. gastrotaenia*).

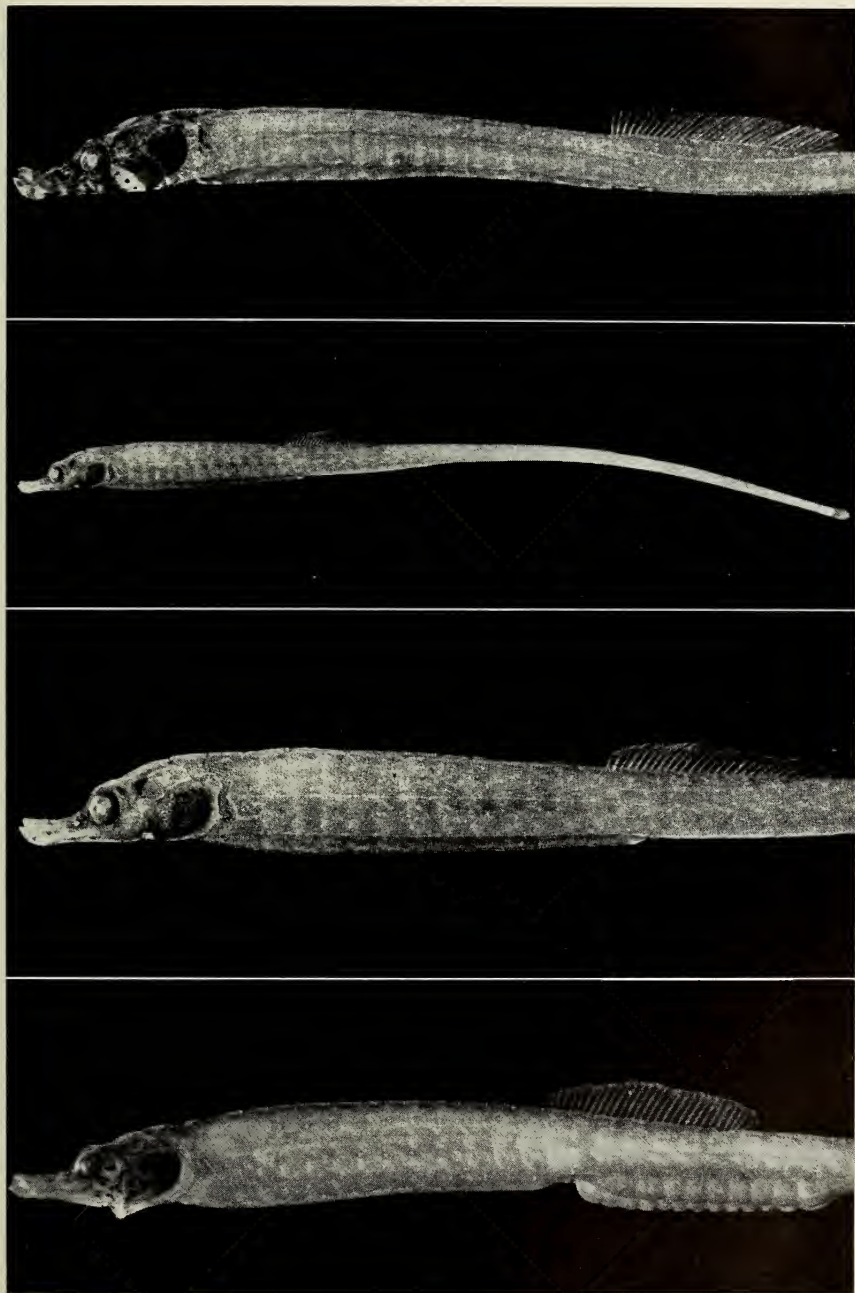


Fig. 1. Top.—*Bhanotia fasciolata*. USNM 217418 (53 mm SL, female), New Guinea.  
Middle pair.—*Bhanotia nuda*. GCRL 15732 (49.5 mm SL, male, paratype), New Guinea.  
Bottom.—*Bhanotia nuda*. GCRL 15731 (51 mm SL, male, paratype), Palau Is.



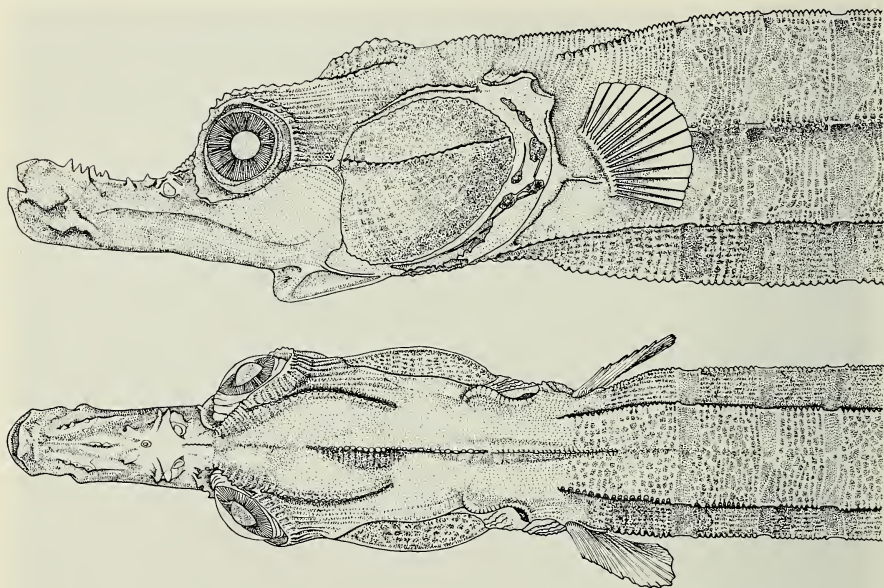


Fig. 2. *Bhanotia fasciolata*. Lateral and dorsal aspects of head and anterior trunk rings. From 69 mm SL male, GCRL 15730.

- Corythoichthys fasciculatus*: Bleeker, 1859:186 ("nomen tantum"; Java).  
*Syngnathus fasciolatus* Duméril, 1870:561 (original description based on specimen described by Kaup, 1856:27; Java).  
*Syngnathus corrugatus* Weber, 1913:112, fig. 38 (original description; Karakelang Is.).  
*Syngnathus fasciolatus*: Duncker, 1915:86 (species dubium).  
*Corythoichthys corrugatus*: Weber and de Beaufort, 1922:73, fig. 32 (new combination).  
*Syngnathus fasciolatus*: Weber and de Beaufort, 1922:83 (descriptions of Kaup and Duméril compared; Java, not Wahai and Ceram).  
*Bhanotia corrugatus* (Weber) [*Syngnathus corrugatus*]: Hora, 1925:464 (type-species of *Bhanotia* Hora, 1925, by original designation).  
 ? *Bhanotia corrugatus*: Hora, 1925:464, text fig. 6, pl. 11, fig. 2 (description; Rutland Is., Andamans).  
*Bhanotia sewelli* Hora, 1925:465, text fig. 7, pl. 11, fig. 5 (original description; Outram Is., Andamans).  
*Bhanotia fasciolata*: Dawson, 1977b:786 (new combination).

*Diagnosis*.—Diagonal anterodorsal snout ridge with 1–5 spines; free bony plates in opercular membrane of adults readily seen under low magnification; with modal counts of 15 trunk rings, 15 pectoral and 32 dorsal-fin rays.

*Description.*—Dorsal-fin rays 29–35 ( $\bar{x}$  = 32.4); pectoral-fin rays 13–16 (14.9); rings 14–16 + 39–42 = 54–58 (55.5); total subdorsal rings 6.5–8.0 (7.4); dorsal-fin origin usually (70.2%) at or before anterior margin of last trunk ring. Proportional data based on 20 specimens 52.0–81.5 (66.2) mm SL follow: HL in SL 9.1–11.0 (9.95); snout length in HL 2.6–2.9 (2.72); snout depth in snout length 2.1–3.1 (2.53); length of dorsal-fin base in HL 0.8–0.9 (0.83); anal ring depth in HL 2.5–3.6 (3.22); trunk depth in HL 1.9–2.5 (2.13); pectoral-fin length in HL 4.6–6.8 (5.44). See Tables 1–4 for additional counts.

Diagonal anterodorsal snout ridge (Figs. 2 and 3) with 1–5 (usually 3–4) minute but distinct spines; subadults and adults with 1–11 smooth to denticulate bony plates in opercular membrane (spines and plates best seen under  $\times 30$  magnification).

Snout light tan in front, dorsum and upper portion of side shading to brown on preorbital and supra-narial projections; side of snout with 9–10, irregularly distributed, small brown spots; lower half of snout and suborbital with 4 brown bars, separated by irregular pale interspaces, which continue across venter of head; posteriormost (broadest) interspace with subvertical median row of 3 equally spaced small brown spots; opercle with two subvertical pale bars originating below median opercular ridge and extending across venter; dorsum of head with faint indications of pale blotches across prenuchal, nuchal and frontal ridges; head elsewhere mainly brown with indistinct tan mottling. Trunk brownish with darker, somewhat ocellate, spots on scutella of lower half of side; tail mottled or tan anteriorly becoming circled along posterior  $\frac{1}{2}$ – $\frac{2}{3}$  by narrow brown bands between rings; anal fin flecked with brown, other fins hyaline. The foregoing description is from a 70.5 mm SL female (UF 23759), but preserved coloration of subadults and adults is highly variable, without apparent correlation with either sex or size. The head may be plain brownish or strikingly marked; opercular and suborbital bars may be prominent, indistinct or absent; the snout may be plain, barred, lightly or densely spotted, or both spotted and barred.

*Comparisons.*—See this section under *B. nuda*.

*Remarks.*—Bony plates are few, smooth, well separated and inconspicuous in the opercular membrane of small (ca. 55 mm SL) *B. fasciolata* (Fig. 3). In large specimens (ca. 70 mm or longer), there are usually 9–11 conspicuous, denticulate, closely spaced plates between upper opercular angle and ventral midline. The opercular membranes of large *B. fasciolata* are essentially armored with bony inclusions.

The holotypes of *Syngnathus fasciolatus* (MNHN 6023) and *Bhanotia sewelli* (ZSI F.10690-1) have bars on the snout and suborbital, but retain no trace of the spotted snout described above and for the holotype of *Syngnathus corrugatus* (Weber, 1913). Among 45 specimens examined,

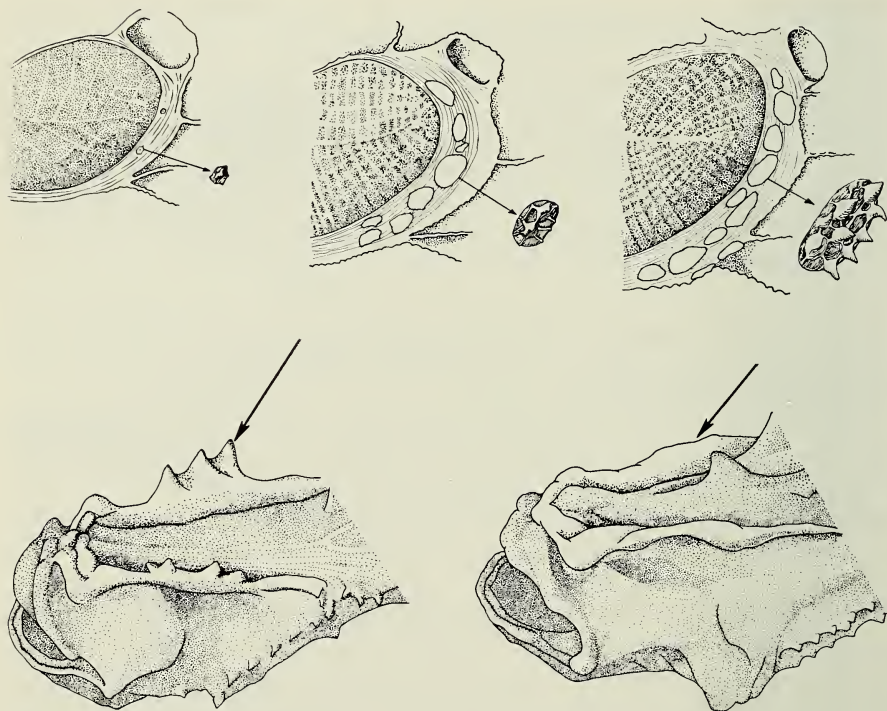


Fig. 3. Ontogenetic development of bony plates in opercular membrane of *Bhanotia fasciolata*; left to right—55 mm, 64.5 mm, 69.5 mm SL. Bottom.—Details of anterior portion of snout illustrating spiny diagonal anterodorsal ridge in *B. fasciolata* (left) and entire ridge in *B. nuda* (right).

19 (42%) have spotted snouts, whereas snout is either plain or barred in the remainder.

Counts of dorsal-fin rays and total subdorsal rings (Tables 2 and 4) indicate west to east increase in frequencies. These data are few and inconclusive but similar variation has been demonstrated for several species of *Corythoichthys* (Dawson, 1977a). I detect no evidence of geographic variation in preserved coloration.

Fifteen egg-bearing males (64–84 mm SL) have brood pouches developed beneath 10–12 tail rings; nineteen other males (63.5–82 mm SL) have pouch folds below 5–13 rings. A single layer of brood-pouch eggs was noted in 7 fish (64–82.5 mm SL) and two layers occurred in 4 fish (76.5–84 mm SL). A 64 mm SL male had 22 eggs in a single layer under the 9 anterior rings of an 11-ring pouch; a 76.5 mm fish, with two layers of eggs, had 46 eggs in the ventral layer under 11 rings of a 12-ring pouch.

On the basis of examined material, *Bhanotia fasciolata* is presently known from the Andaman Is. to the New Hebrides (Fig. 4).



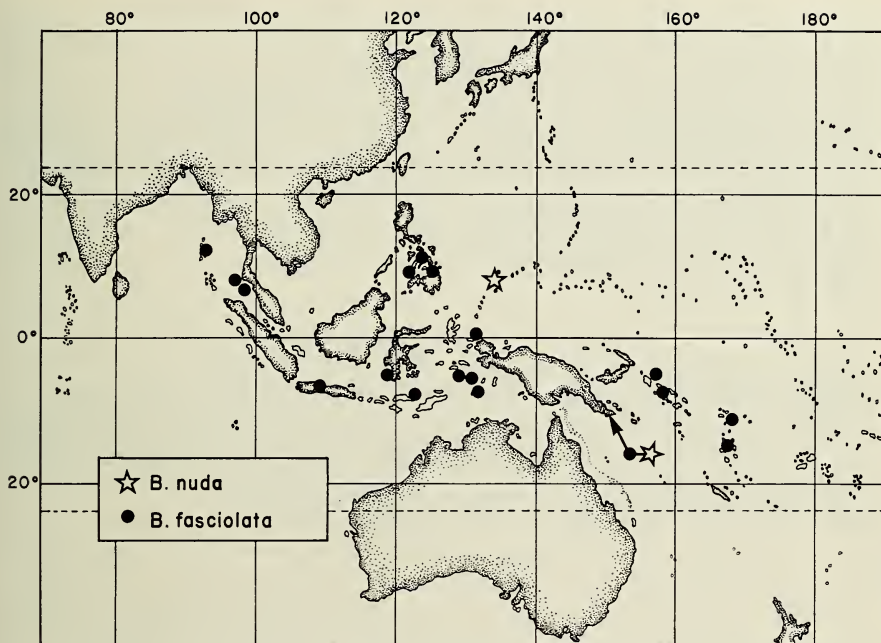


Fig. 4. Distribution of species of *Bhanotia* based on materials examined.

*Material examined*.—132 specimens, 37.0–84.0 mm SL, including holotype.

*Holotype*.—MNHN 6023 (81.0 mm SL, female), Java, Kuhl and van Hasselt.

*Other material*.—ANDAMAN IS.: ZSI F.10690-1 (holotype of *Bhanotia sewelli*), F.10823-1. THAILAND, Phuket: GCRL 15484, USNM 217421. Butang Is.: GCRL 15483, USNM 217419. PHILIPPINES, Negros Is.: CAS 36835, 39648, 39744. Mactan Is.: USNM 137293, 137296. Camiguin Is.: USNM 137294. Mindanao Is.: USNM 137292. Loc. uncertain: CAS 39738. INDONESIA, Macassar: USNM 137295. Flores Is.: GCRL 15725, UF 23759. Saparua: USNM 210657–58. Waigeo: CAS-SU 26699. Banda Is.: BPBM 18532. Tenimber Is.: RMNH 21103. NEW GUINEA, Milne Bay: USNM 217418. SOLOMONS, Bougainville: USNM 217420. New Georgia: CAS 19937–41. SANTA CRUZ IS., Vanikoro: CAS 39743, GCRL 15730. NEW HEBRIDES: AMS IA.784, CAS-SU 25036, UZMK P.39460–61.

*Bhanotia nuda* new species

Fig. 1

*Diagnosis*.—Diagonal anterodorsal snout ridge entire; free bony plates in opercular membranes not readily seen under low magnification; with modal counts of 14 trunk rings, 13 pectoral and 28 dorsal-fin rays.

*Description.*—Dorsal-fin rays 26–30 ( $\bar{x}$  = 28.3); pectoral-fin rays 12–14 (13.1); rings 13–15 + 37–40 = 51–55 (52.6); total subdorsal rings 6.25–7.5 (6.9); dorsal-fin origin always at or behind anterior margin of last trunk ring. Measurements (mm) of the 61 mm SL, male holotype: HL 6.0, snout length 2.1, snout depth 0.9, length of dorsal-fin base 7.7, anal ring depth 2.3, trunk depth 3.3, pectoral-fin length 1.3, length of pectoral-fin base 1.0; see Tables 1–4 for counts. Proportional data based on 20 paratypes 36.5–61.0 ( $\bar{x}$  = 50.6) mm SL follow: HL in SL 8.1–10.1 (9.26); snout length in HL 2.6–3.3 (2.80); snout depth in snout length 2.2–3.8 (2.94); length of dorsal-fin base in HL 0.8–1.1 (0.92); anal ring depth in HL 2.6–5.0 (3.41); trunk depth in HL 1.8–2.9 (2.13); pectoral-fin length in HL 4.7–6.8 (5.48).

Diagonal anterodorsal snout ridge (Fig. 3) low, occasionally somewhat emarginate but without distinct spines. Holotype (Fig. 5) with cluster of 3 spines on anterior third of snout, a large spine on midline and a small spine on either side behind; 3–4 small spines just before origin of median snout ridge and short spiny ridges laterad which are essentially confluent with prominent supra-narial projections; bony opercular membrane plates not visible at  $\times 30$  magnification. Holotype without eggs, pouch plates angled distinctly laterad, pouch folds developed below 11 tail rings.

Holotype without bars on snout, suborbital or opercle, snout essentially pale and unmarked anteriorly of nares; ventral juncture of suborbital and opercle overlaid with a prominent, dark margined, pale spot (diameter subequal to that of pupil), spot circular on right but narrowed on the left side and continued ventrad on opercular membrane; snout behind vertical from nares, most of suborbital and opercle with scattered diffuse brown spots; remainder of head and trunk brown, without distinctive markings; tail mainly light tan with traces of dark bands circling margins of the last 15 or so rings; dorsal and pectoral fins mainly hyaline but closely flecked with minute translucent spots between fin-rays; anal and caudal fins hyaline.

Twenty-nine of 57 examined paratypes have one, infrequently two, pale bars on suborbital and 23 of these also have 2–3 narrow pale bars on lower half of opercle, the ocellate pale spot overlying anterior opercular angle (described for holotype) occurs in 9 specimens, 10 have brown spotted opercle and suborbital, and head is without conspicuous markings in 9 others. None of the paratypes have bars on lower half of snout, most are without snout markings and only 10 have spotted snouts.

*Etymology.*—Named *nuda* in allusion to the absence of spines on diagonal anterodorsal snout ridge and absence of obvious bony plates in the opercular membrane.

*Comparisons.*—*Bhanotia nuda* is best separated from its only congener, *B. fasciolata*, by modal counts of 14 trunk rings and 13 pectoral rays (both counts modally 15 in *fasciolata*) and absence of spines on the diagonal



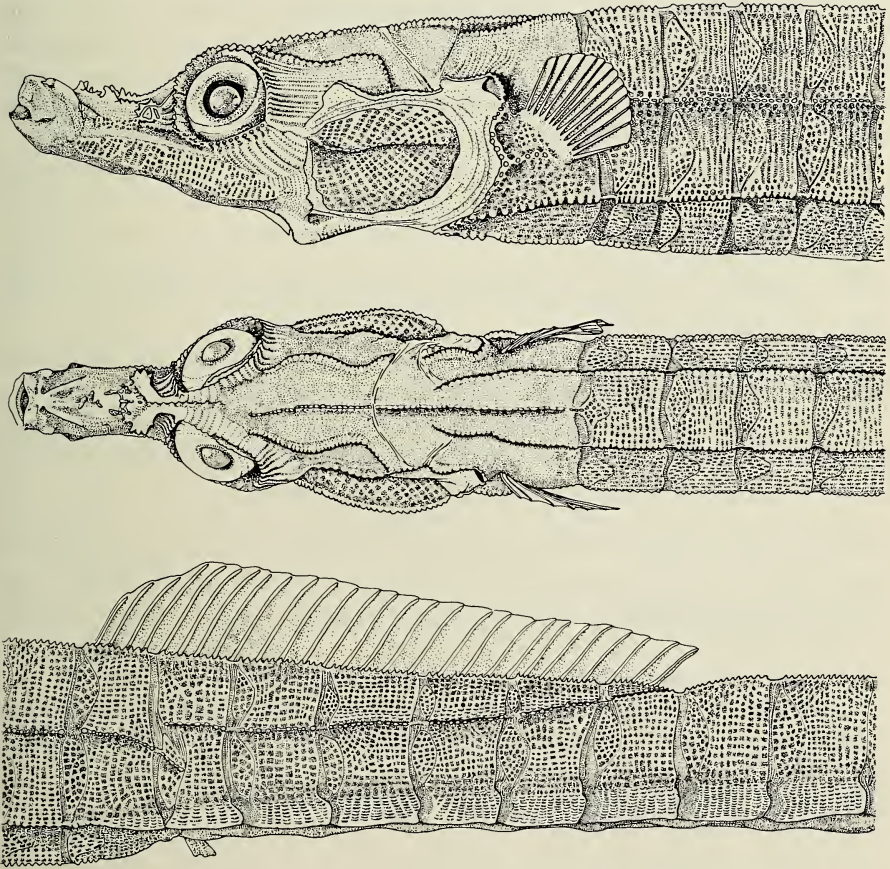


Fig. 5. *Bhanotia nuda*. Top and middle.—Lateral and dorsal aspects of head and anterior trunk rings. Bottom.—Posterior trunk and anterior tail rings illustrating ridge pattern and dorsal fin. From 61 mm SL holotype, CAS 40169.

anterodorsal snout ridges (spiny in *fasciolata*). Average counts of tail rings and dorsal-fin rays are lower in *B. nuda* ( $\bar{x} = 38.6$  and  $28.3$  against  $40.5$  and  $32.4$  in *fasciolata*), and dorsal-fin origin is always at or behind anterior margin of last trunk ring (usually (70%) at or before margin in *fasciolata*). Under  $\times 30$  magnification, opercular membranes are superficially naked in all examined *B. nuda*, whereas free bony plates are visible in the opercular membranes of all *B. fasciolata* above 55 mm SL. Although these species are similar in general coloration, *B. nuda* lacks bars on lower half of snout (bars present in more than 50% of examined *fasciolata*), about 14% have spotted opercle and suborbital (never spotted in *fasciolata*) and

only 18% have spotted snouts (42% in *fasciolata*). Based on examined material, *B. nuda* matures at a smaller size (smallest egg-bearing male 47.5 mm SL against 64 mm in *fasciolata*), and does not attain the maximum length of *B. fasciolata* (maximum 61.5 mm SL against 84 mm). These closely related species are readily separated by characters noted here and in diagnoses.

*Remarks.*—Free bony plates are poorly developed in the opercular membranes of *B. nuda* and they are not visible in any of the untreated type-material. However, one or two small, smooth, plates are present below ventral margin of opercle in two bleached and stained specimens (GCRL 15731; 58–60 mm SL), and plates may well be better developed in fish larger than 61.5 mm SL.

Five egg-bearing males (47.5–61.5 mm SL) have brood pouches developed below 11–12 tail rings; 11 other males have pouch folds below 10–12 rings. A single layer of 21–22 eggs is present in two fish (47.5–51 mm SL), three (58–61.5 mm) have eggs in two layers, and the largest of these has 29 eggs in the ventral layer under 11 rings of a 12-ring pouch.

*Bhanotia nuda* is known from New Guinea and the Palau Is. (Fig. 4). This species is sympatric with *B. fasciolata* in New Guinea (one *fasciolata* taken with 17 *nuda*) but the Palau collections contained only *B. nuda*. The New Guinea collection is recorded from “brackish” water; Palau samples are from tidepool, reef and mudflat habitats.

*Material examined.*—Holotype and 58 paratypes, 30.5–61.5 mm SL.

*Holotype.*—CAS 40169 (61.0 mm SL, male); Palau Is., NE of Station Harbor off SE part of Arakabesan Is.; 07°20'51"N, 134°38'01"E; reef pool with coral heads, rubble and eelgrass; 0–1.8 m; GVF reg. 1853; 22 Jan. 1959; H. A. Fehlmann and Y. Sumang.

*Paratypes.*—NEW GUINEA: GCRL 15732 (3, 47.5–51.0) and USNM 207444 (14, 33.5–50.5); Milne Bay, Maiwara Is., W of Alotau; brackish water; 3 Sept. 1975; T. R. Roberts coll. PALAU IS.: CAS 39740 (18, 32–61.5) and GCRL 15731 (4, 51–61); off Babelthaup Is., NE of Arakatoach stream; 07°23'28"N, 134°30'32"E; coral algae, some eelgrass, sand bottom; 0–3 m; 22 Sept. 1957; GVF reg. 1397; H. A. Fehlmann and party. CAS 39741 (4, 51–56), taken with holotype. CAS 39739 (8, 41–59.5); W end of Koror Is.; 07°26'36"N, 134°28'13"E; mud and sand flat; 0–0.9 m; 9 July 1955; GVF reg. 511; H. A. Fehlmann and party. CAS 39742 (7, 30.5–53), between Koror and Byobu islands; 07°19'36"N, 134°29'06"E; mudflat with occasional blades of eelgrass and scattered patches of soft coral; 0–0.4 m; 25 July 1956; GVF reg. 814; M. R. Brittan and party.

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